

REMARKS

The Examiner objected to the drawings because reference number “22” was used to designate both “processing software” and “imaging chip”. The above amendments to the specification cure this defect by bring the specification into agreement with Figure 1. Accordingly, no changes to Figure 1 are needed.

The Examiner also objected to Figure 2 because reference numbers 24 and 25 are not mentioned in the description. A replacement sheet for Figure 2 in which these reference numbers have been removed is included with this response.

The Examiner objected to the specification because of a number of informalities. The above amendments provide the requested corrections.

The Examiner rejected claims 1, 3-4, 6, 11, 13-15 17 and 19 under 35 U.S.C. 102(b) as being anticipated by Michael, *et al* (hereafter "Michael '125") (US 5,960,125) which incorporates teachings from Michael, *et al* (hereafter "Michael '893")(US 6,137,893) and consequently, Michael (hereafter "Michael '326")(US 5,548,326). Applicant traverses this rejection.

Regarding claims 1, 11 and 19 the Examiner asserts that Michael '125 teaches translating displacement coordinates for the targets into position coordinates for the stage to determine the position of the stage. Applicant must disagree with the Examiner's reading of Michael '125.

Michael '125 teaches a system for determining the position of an object on a stage relative to the known location of the stage in a coordinate system that is fixed with respect to a reference point that does not move with the stage. The coordinates determined for the object are then used to determine a displacement for the stage that will bring the object to a desired location. To simplify the following discussion, the coordinates within an image at which a target is located will be referred to as the relative displacement of the target in the camera field of view. The position of the camera relative to a fixed coordinate system defined by some reference point that does not move with respect to the stage will be referred

to as the camera absolute position. Finally, the position of the stage relative to the fixed coordinate system will be referred to as the stage position.

Michael '125 assumes that the position of the stage is known at all times, and in particular, is already known at the start of the calibration process. Michael '125 provides a calibration system in which the absolute position of the cameras in the fixed coordinate system is determined so that any point in a camera field of view can be translated from the determined relative displacement of that point in the camera field of view to a coordinate in the fixed coordinate system. During operation of the stage after the calibration has been completed, an object in a camera image is located and assigned a relative displacement within the camera image, i.e., a position relative to a point in the camera field of view. The calibration system provided by Michael '125 then translates that relative position to an absolute position in a stage fixed coordinate system so that the object can be moved to the desired position in that coordinate system for processing. Hence, Michael '125 does not teach determining the position of the stage, which is already known. Michael '125 teaches translating the displacement coordinates of the targets to position coordinates for the cameras in the absolute position coordinate system. Accordingly, Applicant submits that Claims 1, 11, 19, and the claims dependent therefrom are not anticipated by the Michael references.

The Examiner rejected claims 2 and 12 under 35 U.S.C. 103(a) as being unpatentable over Michael '125 in combination with Douglas (US 5,943,089). Applicant traverses this rejection.

According to the Examiner, Michael '125 teaches the elements of claims 1 and 11 as described in the 102 rejection above. The Examiner admits that Michael '125 does not teach a system and method wherein capturing images includes illuminating the plurality of targets. The Examiner looks to Douglas for the missing teachings.

First, as noted above, Applicant maintains that Michael '125 does not teach all of the elements of Claims 1 and 11. Douglas does not provide the missing teachings. Hence, even if one were to make the combination suggested by the Examiner, the resulting device would not satisfy the limitations of the claims in question.

Second, Applicant submits that the device obtained by substituting the probe of Douglas shown in Figure 3 for the cameras of Michael '125 would render the apparatus of Michael '125 effectively inoperative. The probe taught in Douglas provides an overlaid image of two fields of view that are separated spatially. Hence, the image of a target obtained with that probe would be an overlaid image of two different parts of the target. The resulting image would not be usable to compare to an image of the target to determine the position of the target in the field of view. Hence, the Examiner's motivation for combining the references is flawed. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 2 and 12.

The Examiner rejected Claim 5 under 35 U.S.C. 103(a) as being unpatentable over Michael '125 in combination with Guha, *et al* (hereafter "Guha) (US 2002/010 9112). Applicant traverses this rejection.

The Examiner maintains that Michael '125 teaches all of the limitations of Claim 5 except for imaging chip limitation. The Examiner looks to Guha for the missing teachings.

As noted above, Applicant maintains that Michael '125 does not teach all of the elements of Claim 1. Guha does not provide the missing teachings. Hence, even if one were to make the combination suggested by the Examiner, the resulting device would not satisfy the limitations of claim 5.

The Examiner looks to Figure 7 of Guha as teaching a camera that satisfies the additional limitations of Claim 5. The Examiner maintains that it would be obvious to substitute the smart camera of Guha for each of the cameras in Michael '125 because it would require fewer components than the system taught in Michael '125, and hence, increase the mean time between failures.

First, it should be noted that Guha does not teach an imaging sensor that determines the position of a target in a field of view by comparing the target to a stored image. The camera of Guha compares an image of a printed web with a template image to determine if there is a 2-dimensional "blob" in the printed image. Such a blob would be grounds for

rejecting the printed web. Hence, the camera of Guha does not compare images to provide displacement information with respect to a target in the acquired image.

Second, there is no teaching that the camera is constructed on an imaging chip.

Third, the Examiner has not pointed to any teaching in the references that the camera of Guha has fewer components than the camera taught in Michael '125. If anything, it would appear that the resultant system would have more components, since the image comparison hardware would need to be duplicated in each camera in the device suggested by the Examiner. The system of Michael '125 uses one shared image processing system to process the images from each of the cameras. Hence, Applicant submits that the Examiner's motivation for combining the references is flawed in that the resultant device would have no advantage over that taught in Michael '125. In addition, the resultant device would not satisfy the limitations of the base claim or the further limitations of Claim 5. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 5.

The Examiner rejected claims 7, 10, 16, 18 and 20 under 35 U.S.C. 103(a) as being unpatentable over Michael '125 in combination with Wallack (US 6,771,808). Applicant traverses this rejection.

The Examiner stated that Michael '125 teaches the elements of Claims 1, 11 and 19 but does not teach a system and method wherein there are six position coordinates for the stage. The Examiner looks to Wallack as providing the missing teachings. The Examiner maintains that it would be obvious to include the six degrees of freedom search tool of Wallack to train the vision system of Michael '125 to register the instance of a pattern in an arbitrary six-degree of freedom pose.

As noted above, Applicant maintains that Michael '125 does not teach all of the elements of Claims 1, 11, and 19. Wallack does not provide the missing teachings. Hence, even if one were to make the combination suggested by the Examiner, the resulting device would not satisfy the limitations of Claim 7.

With respect to the teachings of Wallack, it should be noted that the cameras of Michael '125 would need to be oriented at different angles than those taught in Michael '125 to provide the data needed by the system of Wallack. Altering the camera angles would result in the images of the top surface of the stage being out of focus over part of the image, and hence unusable for the purposes taught in Michael '125. Accordingly, one would need to add cameras to the system taught in Michael '125 or provide some form of rotational motion to the existing cameras to provide the additional data. In either case, the cost of the camera system taught in Michael '125 would be increased by providing the additional capability. In addition, the system of Michael '125 assumes that the stage only moves in two dimensions; hence, nothing would be gained by detecting changes in the remaining four degrees of freedom taught in Wallack since they do not occur in the Michael '125 system.

Accordingly, Applicant submits that the combined system does not satisfy all of the limitations of the claims in question. Furthermore, the Examiner's rationale for combining the systems does not lead to an improvement in the Michael '125 system. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to claims in question.

The Examiner rejected Claim 8 under 35 U.S.C. 103(a) as being unpatentable over Michael '125 in combination with Batterman, *et al* (hereafter "Batterman") (US 5,856,844). Applicant traverses this rejection

The Examiner stated that Michael '125 teaches the elements of Claims 1 but does not teach that the targets are placed at oblique angles to all surfaces of the stage. The Examiner looks to Batterman for the missing teachings and maintains that it would be obvious to use the target system of Batterman in the device of Michael '125 because it increases the range of degrees of freedom. Specifically, the Examiner looks to the embodiment shown in Figure 11 of Batterman.

As noted above, Applicant maintains that Michael '125 does not teach all of the elements of Claim 1. Batterman does not provide the missing teachings. Hence, even if one

were to make the combination suggested by the Examiner, the resulting device would not satisfy the limitations of Claim 8.

First, Applicant must point out that the Examiner has not proposed any manner by which the head shown in Figure 11 is to be mounted on the stage of Michael '125 to provide the combined device. In this regard, if the head that is attached to handle 90 shown in the drawing were to be placed on the stage of Michael '125, the resultant system would not satisfy the limitations of Claim 8, since target 80A would not be at an opaque angle with respect to the stage. Second, the cameras of Michael '125 are not positioned such that the oblique targets would be in focus in the images taken by the cameras. Third, the system of Michael '125 requires that each camera be able to image multiple targets. The oblique targets of Batterman would not provide this capability, since only one target would be in focus for each camera. Finally, as noted above, there is no reason to provide the additional degrees of freedom in the system taught in Michael '125, since that system assumes a stage that moves in only two dimensions.

Accordingly, Applicant submits that the combined system does not satisfy all of the limitations of Claim 8. Furthermore, the Examiner's rationale for combining the systems does not lead to an improvement in the Michael '125 system. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to claims in question

The Examiner rejected Claim 9 under 35 U.S.C. 103(a) as being unpatentable over the combination of Michael '125 and Batterman as applied to Claim 8 above, and further in view of Michael, et al (hereafter " Michael '443") (US 5,768,443). Applicant traverses this rejection.

The Examiner maintains that Michael '125 and Batterman teach all of the limitations of Claim 9 with the exception of a sensor for each target, the sensor being aligned normally perpendicular to the target plane while the target planes are at oblique angles to all of the surfaces of the stage. The Examiner looks to Michael '443 for the missing teachings. The

Examiner maintains that the combination would eliminate distortion due to tilt of the camera in either the x-axis or y-axis with respect to the plane of the calibration target.

As noted above, Applicant submits that the combination of Michael '125 and Batterman does not teach all of the limitations of Claim 9 with the exception of the limitations described above. Michael '443 does not provide the missing teachings.

The Examiner looks to Figure 4 of Michael '443 as teaching each target has a camera that has its axis aligned perpendicular to the normal to the plane of a calibration substrate used to calibrate the cameras. The calibration substrate in question has three different surfaces at different angles to the underlying stage. The center plane is parallel to the plane of the stage. It should be noted that the targets are not used during the actual operation of the stage with a wafer on the stage, but rather to calibrate the cameras for distortions in the cameras. Hence, the targets are not used, or even usable, to provide a determination of the absolute coordinates of the stage. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 9.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read "Calvin B. Ward".

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